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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SOWARD, IDA M	
ART UNIT	**PAPER NUMBER**
2822	

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,297	YASUO OHBA	
	Examiner	Art Unit	
	Ida M. Soward	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 August 2005*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *4-13,21 and 22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *4-6,8-13,21 and 22* is/are rejected.

7)☒ Claim(s) *7* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *09-20-05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Applicant's amendment filed August 30, 2005.

Drawings

The objection to the drawings has been withdrawn.

Specification

The objection to the specification has been withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 5 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (5,146,465) in view of Kraus et al. (US 6,218,293 B1) and Kubota et al. (US 6,661,822 B1).

In regard to claims 4, Khan et al teach a nitride compound semiconductor element (title and Figure 5) comprising:

a sapphire substrate 79 (Figure 5, column 8, lines 8-1 1),

a first single crystalline (column 2, lines 55-58) layer 81 of AlN (Figure 5, column 8, lines 1 1-14) formed on the sapphire substrate 79;

a second single crystalline (column 2, lines 55-58) layer 83 (column 8, lines 14-17) formed on the first single crystalline layer, the second crystalline layer 83 being made of $Al_xGa_{1-x}N$ (column 8, line 16), where x can assume any value between 0 and 1, which is in the range of $0.85 \leq x \leq 0.95$ (column 8, lines 15-17), and

a device structure section of a nitride compound semiconductor 87/91/94/95 (Figure 5, column 8, lines 20-40) formed on the second single crystalline layer.

However, Khan et al. fail to teach an AlN layer doped with carbon having a concentration of equal to or more than 3×10^{18} com^{-3} and equal to or less than 1×10^{20} cm^{-3}; and an $Al_xGa_{1-x}N$ layer having a thickness of equal to or more than 0.7 μm and equal to or less than 3 μm.

In regard to claim 4, Kraus et al. teach an AlN layer doped with carbon having a concentration of equal to or more than 3×10^{18} com^{-3} and equal to or less than 1×10^{20} cm^{-3} (column 5, lines 25-39).

In regard to claims 4, Kubota et al. teach an $Al_xGa_{1-x}N$ layer 47 having a thickness of more than 0 μm and less then 5 μm (Figure 8A, column 10, lines 15-16) which is in the range of equal to or more than 0.7 μm and equal to or less than 3 μm.

In regard to claim 21, Khan et al. and Kubota et al. teach the claimed nitride compound semiconductor device structure as described above. Moreover, "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a

product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (See MPEP § 2113)

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nitride compound semiconductor element structure as taught by Khan et al. with the nitride compound semiconductor device as taught by Kraus et al. and the nitride compound semiconductor element having an $Al_xGa_{1-x}N$ layer with a thickness of more than 0 μm and less then 5 μm as taught by Kubota et al. to provide a semiconductor element capable of incorporating high resistance area (column 12, lines 30-33).

In regard to claim 5, Khan et al. shows the sapphire substrate 79 without warp (Figure 5).

In regard to claim 22, Khan et al. teach a nitride compound semiconductor element comprising a semiconductor laser (title and column 1, lines 6-9).

Claims 6 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (5,146,465) and Kraus et al. (US 6,218,293 B1) as applied to claims 1, 3 and 5 and 21-22 above, and further in view of Kubota et al. (US 6,661,822 B1).

Khan et al. and Kraus et al. teach all mentioned in the rejection above.

However, Khan et al. and Krause et al. fail to teach a single crystalline AlN protective layer formed directly on a second single crystalline layer, wherein the AlN

protective layer having a thickness of equal to or more than 1 nm and equal to or less than 10 nm; an $Al_yGa_{1-y}N$ wherein y has values of between 0 and 1 (columns 8-9, lines 65-68 and 1, respectively), which is in the range of $0.25 \leq y \leq 0.75$; and an $Al_yGa_{1-y}N$ layer formed between an $Al_xGa_{1-x}N$ layer and a device structure section, wherein the $Al_yGa_{1-y}N$ layer has a thickness of equal to or more than 0.3 μm and equal to or less than 3 μm.

In regard to claim 6, Kubota et al. teach a single crystalline AlN protective layer 38 (Figures 5F, 6B and 7B, column 7, lines 62-63) formed directly on a $Al_xGa_{1-x}N$ layer 36 (Figures 5F, 6B and 7B, column 6, lines 65-66), wherein the AlN protective layer 38 having a thickness of more than 0 nm, preferably 1 nm, but less than 300 nm (Figures 5F, 6B and 7B, column 8, lines 45-47) which is in the range of equal to or more than 1 nm and equal to or less than 10 nm.

In regard to claim 6, the limitations concerning the function of a layer (such as protective) and "for preventing Ga atoms from evaporating from the second single crystalline layer to thereby protect the second single crystalline layer", claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function, In re Danly, 263, F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does. Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

In regard to claim 10, Kubota et al. teach an $Al_yGa_{1-y}N$ layer 47 formed between an $Al_xGa_{1-x}N$ layer 45 and a device structure section 47b/49/50/51/52/52a/53, wherein an $Al_yGa_{1-y}N$ y has values of between 0 and 1 (columns 8-9, lines 65-68 and 1,

respectively), which is in the range of $0.25 \leq y \leq 0.75$ and the $Al_yGa_{1-y}N$ layer 47 has a thickness of 0.3μm (Figure 8G, column 10, lines 9-25) which is in the range of equal to or more than 0.3 μm and equal to or less than 3 μm.

In regard to claim 10, the limitations concerning the function of a layer (such as lattice modification), claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function, In re Danly, 263, F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does. Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nitride compound semiconductor element structure as taught by Khan et al. and Kraus et al. with the nitride compound semiconductor element having a single crystalline AlN protective layer formed directly on a second single crystalline layer, wherein the AlN protective layer having a thickness of more than 0 nm, preferably 1 nm, but less than 300 nm; and an $Al_yGa_{1-y}N$ layer formed between an $Al_xGa_{1-x}N$ layer and a device structure section, wherein the $Al_yGa_{1-y}N$ layer has a thickness of 0.3μm as taught by Kubota et al to provide a nitride compound semiconductor element that can be employed as a reading/writing light source for a magneto-optic disk device or a light source for a laser printer (column 1, lines 9-14).

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (5,146,465), Kraus et al. (US 6,218,293 B1) and Kubota et al. (US 6,661,822 B1) as applied to claims 1, 3, 5 and 21-22 above, and further in view of Takeuchi et al. (US 2001/0038656 A1).

Khan et al., Kraus et al. and Kubota et al. teach all mentioned in the rejection above. Khan et al. further teach a nitride compound semiconductor element comprising a semiconductor laser (title, abstract and column 5, line 50).

However, Khan et al., Kraus et al. and Kubota et al. fail to teach a device structure section comprising: a first conductive-type semiconductor layer; an active layer formed on the first conductive-type semiconductor layer; and a second conductive-type semiconductor layer formed on the active layer.

Takeuchi et al. teach a device structure section comprising: a first conductive-type semiconductor layer 25; an active layer 26 formed on the first conductive-type semiconductor layer 25; and a second conductive-type semiconductor layer 27 formed on the active layer 26 (Figure 2, page 5, paragraphs [0054]).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nitride compound semiconductor element structure as taught by Khan et al. and Kraus et al. with the nitride compound semiconductor element having an $Al_xGa_{1-x}N$ layer with a thickness of more than 0 μm and less then 5 μm as taught by Kubota et al. with the nitride compound semiconductor element having a first conductive-type semiconductor layer; an active layer formed on the first conductive-type semiconductor layer; and a second conductive-type

semiconductor layer formed on the active layer as taught by Takeuchi et al. to provide a nitride compound semiconductor structure capable that can be incorporated into a semiconductor laser diode that generates short-wavelength coherent light having a far-field pattern that exhibits a single peak (page 2, paragraph [0023]).

Concerning the limitation "for emitting light by current injection", claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function, In re Danly, 263, F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does. Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (5,146,465), Kraus et al. (US 6,218,293 B1), Kubota et al. (US 6,661,822 B1) and Takeuchi et al. (US 2001/0038656 A1) as applied to claim 8 above, and further in view of Morita et al. (US 2001/0048114 A1).

Khan et al., Kraus et al., Kubota et al. and Takeuchi et al. teach all mentioned in the rejection above. However, Khan et al., Kraus et al., Kubota et al. and Takeuchi et al. fail to teach an active layer containing a well layer made of $Ga_{1-z}In_zN$ ($0.15 \leq z \leq 0.3$).

Morita et al. teach an active layer containing a well layer made of $Ga_{1-z}In_zN$ ($0 \leq z \leq 1$) (page 3, paragraph [0029]), which is in the range of ($0.15 \leq z \leq 0.3$).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nitride compound semiconductor element structure as taught by Khan et al. and Kraus et al., the nitride compound semiconductor

element having an $Al_xGa_{1-x}N$ layer with a thickness of more than 0 μm and less then 5 μm as taught by Kubota et al. and the nitride compound semiconductor element having a first conductive-type semiconductor layer; an active layer formed on the first conductive-type semiconductor layer; and a second conductive-type semiconductor layer formed on the active layer as taught by Takeuchi et al. with the nitride compound semiconductor element having an active layer containing a well layer made of $Ga_{1-z}In_zN$ ($0 \leq z \leq 1$) as taught by Morita et al. to provide a nitride compound semiconductor device that exhibits an optically excellent quality with substantially no unevenness, and suitable for use as cavity edges of semiconductor lasers (page 2, paragraph [0022]).

Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (5,146,465), Kraus et al. (US 6,218,293 B1) and Kubota et al. (US 6,661,822 B1) as applied to claims 6 and 10 above, and further in view of Taskar et al. (5,915,164).

Khan et al., Kraus et al. and Kubota et al. teach all mentioned in the rejection above. However, Khan et al., Kraus et al. and Kubota et al. fail to teach a nitride compound semiconductor element comprising an optical switch or a field effect transistor; and a device structure section having a heterojunction of an AlN layer and a GaN layer.

Taskar et al. teach a nitride compound semiconductor element comprising a field effect transistor; and a device structure section having a heterojunction of an AlN layer 3 and a GaN layer 2 (Figure 1, column 2, lines 43-55).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nitride compound semiconductor element structure as taught by Khan et al. and Kraus et al.; and the nitride compound semiconductor element having a single crystalline AlN protective layer formed directly on a second single crystalline layer, wherein the AlN protective layer having a thickness of more than 0 nm, preferably 1 nm, but less than 300 nm; and an $Al_yGa_{1-y}N$ layer formed between an $Al_xGa_{1-x}N$ layer and a device structure section, wherein the $Al_yGa_{1-y}N$ layer has a thickness of 0.3μm as taught by Kubota et al. with the nitride compound semiconductor element comprising a field effect transistor; and a device structure section having a heterojunction of an AlN layer and a GaN layer as taught by Taskar et al. to provide a semiconductor device capable of being operated at high voltages (columns 2-3, lines 64-67 and 1-3, respectively).

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (5,146,465), Kraus et al. (US 6,218,293 B1), Kubota et al. (US 6,661,822 B1) and Taskar et al. (5,915,164) as applied to claims 11-12 above, and further in view of Ishikawa et al. (US 2002/0001864 A1).

Khan et al., Kraus et al., Kubota et al. Taskar et al. teach all mentioned in the rejection above. However, Khan et al., Kraus et al., Kubota et al. Taskar et al. fail to teach a nitride compound semiconductor element comprising an optical switch.

Taskar et al. teach a nitride compound semiconductor element comprising an optical switch (pages 7-8, paragraph [0117]).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nitride compound semiconductor element structure as taught by Khan et al. and Kraus et al., the nitride compound semiconductor element having a single crystalline AlN protective layer formed directly on a second single crystalline layer, wherein the AlN protective layer having a thickness of more than 0 nm, preferably 1 nm, but less than 300 nm; and an $Al_yGa_{1-y}N$ layer formed between an $Al_xGa_{1-x}N$ layer and a device structure section, wherein the $Al_yGa_{1-y}N$ layer has a thickness of 0.3μm as taught by Kubota et al. and the nitride compound semiconductor element comprising a field effect transistor; and a device structure section having a heterojunction of an AlN layer and a GaN layer as taught by Taskar et al. with the nitride compound semiconductor element comprising an optical switch to provide a semiconductor device capable of having the productivity necessary for cost reduction (page 8, paragraph [0117]).

Allowable Subject Matter

Claim 7 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respect to nitride compound semiconductor devices:

Koike et al. (US 6,541,798 B2) Koike et al. (US 6,680,957 B1)

Manabe et al. (US 2002/0060326 A1) Manabe et al. (US 6,607,595 B1)

Ota et al. (US 6,259,122 B1) Senda et al. (US 2003/0109076 A1)

Shibata et al. (US 2002/0014629 A1).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M. Soward whose telephone number is 571-272-1845. The examiner can normally be reached on Monday - Thursday 6:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra V. Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

IMS
November 14, 2005

John M. Swan
AU 2822